Chapter 14

OBJECTIVES AND CONSERVATION MEASURES

The purpose of this chapter is to the describe objectives, performance standards, conservation strategies, and actions/measures (except habitat) for the Lower Columbia Steelhead Conservation Initiative (LCSCI) in the context of the factors for decline that they are intended to address. Although habitat objectives, performance measures, and strategies are included in this chapter, habitat actions/measures are listed in Appendix 4. Key linkages to monitoring aspects are also noted where possible, especially for fish management and dams/hydropower sections. Also, an attempt was made here to highlight instances where Oregon's draft Steelhead Supplement to the Oregon Plan (SSOP) contains measures pertinent similar to those in this LCSCI. Further coordination between Washington and Oregon in the LCSCI area is planned to identify and bolster similarities.

An attempt was made to reflect appropriate information from other governmental entities, tribes, industry, and other stakeholders. As available, additional material will be included in subsequent LCSCI documents.

This chapter is subdivided into three "subchapters": Fish Management, Habitat, and Tributary Dams/Hydropower. Information in these subchapters resulted from the respective efforts of three corresponding interagency work groups. The lead agency for preparation of each subchapter were WDFW, Subchapter 1: Fish Management; Department or Ecology (Ecology), Subchapter 2: Habitat; and WDFW/Ecology, Subchapter 3: Tributary Dams/Hydropower. In this document, material in Subchapters 2 and 3 reflects contributions from a range of agencies/entities, whereas Subchapter 1 pertains essentially only to material from WDFW.

This draft of the LCSCI contains a separate chapter (Chapter 15) that organizes priority fish management and habitat conservation actions from this chapter using the prioritization framework outlined in Chapter 12 (Tiers 1 through 5).

As listed throughout the LCSCI, Phase 1 conservation actions are those that will be accomplished using currently available resources and authorities, whereas Phase 2 actions will require additional funding or authorities.

Subchapter 1: Fish Management

The purpose of this subchapter is to provide detail about fish management conservation objectives and measures for fish management related to the factors for decline that they are intended to address. Agency-specific codes for each measure are shown. For example, DFWIA1 refers to WDFW (agency-DFW) and IA1 refers to a specific measure. Key linkages to monitoring aspects are also noted. Finally, an attempt was made here to highlight instances where the draft SSOP contains measures similar to those in this draft of the LCSCI. Further coordination between WDFW and ODFW is planned to identify and bolster similarities, where benefits of bi-state coordination would be especially valuable.

In contrast to the LCSCI Pre-Draft, each measure in this subchapter contains performance standards (linked to the WSP), indicates timelines for each Phase, key contacts, and funding source(s).

GENETIC CONSERVATION

Factor for Decline:

I. Loss Of Genetic Diversity And Long Term Productivity

Long term productivity of wild steelhead requires a diversity of populations that are adapted to the variations in their local environments. Loss of genetic diversity both within and between populations leads to wild steelhead stocks with decreased productivity.

Biological Objective:

A. Contain genetic risks to wild steelhead stocks imposed by small population sizes, gene flow from hatchery fish, fishery selectivity, and habitat fragmentation and loss, to maintain and restore biological characteristics and population structure within and between stocks of wild steelhead.

Conservation Measures:

DFW IA1. Establish genetic conservation goals for stocks and genetic diversity units, gene flow, minimum spawner abundance, and fishery selectivity levels.

Background: In the Wild Salmonid Policy (WFWC 1997; WDFW 1997a), the need to delineate genetic diversity units, and establish goals for gene flow, minimum spawner abundance, and fishery selectivity is described. Over time wild fish populations have become locally adapted to their environment, accumulating traits that provide greater likelihood of long term survival and productivity under local conditions. Adaptations of populations to different local conditions leads to greater genetic diversity. The maintenance of this diversity allows populations to respond to constantly changing local

environments. Understanding the type and extent of genetic diversity present within steelhead, coupled with goals for the minimum allowable number of spawners, maximum extent of gene flow, and fishery selectivity are intended to prevent the loss of rare traits and to protect genetic diversity, local adaptation, and long term productivity.

WSP Performance Standards:
Minimum Genetic Spawner Abundance: Greater than 600 wild summer steelhead and 750 wild winter steelhead, except for historically small populations in small streams. (Abundance levels are based on the WSP spawner target of 3,000, divided by the average age of spawners).
Gene Flow: The surrogate measure of gene flow for each stock will be the percentage of hatchery spawners in the combined hatchery plus wild spawner aggregate. The maximum percentage of hatchery spawners for dissimilar stocks will be less than 1%, less than 5% for intermediate stocks, and less than 10% for similar stocks.
Fishery selectivity: will be managed to maintain population characteristics similar to wild unfished steelhead populations. Characteristics such as size, fecundity, spawning tine, age at maturity, and run timing will be monitored.

Phase 1: Develop performance standards for minimum spawner abundance, gene flow, and selectivity.
Timeline: Task complete with adoption of the Wild Salmonid Policy
Funding: State, federal

Phase 2. Develop genetic risk assessments where WSP performance standards in Phase 1 are not being achieved. Assessments will use data complied in conservation measures DFW IA6 (biological and genetic monitoring) and include options to meet performance standards. Risk assessments will follow the prioritization framework in Chapter 12, beginning with Tier 1 and 2 stocks/watersheds.
Timeline: Tier 1 and 2 - 1998/99, Tier 3 and 4 - 1999/00, and Tier 5 - 2000/01
Funding: Unknown; likely state - federal
Contacts: Phase 1 and 2; Steve Phelps (360) 902-2771 and Dan Rawding (360) 696-6211

DFW IA2. Manage escapements of wild spawners to ensure minimum abundance goals are met or exceeded.

Background: Wild steelhead spawner escapement goals for management purposes are generally larger than those needed to achieve minimums for genetic conservation purposes. Since there has not been a legal sport harvest of wild adult steelhead since the mid-1980s, harvest management of wild adult steelhead in the LCSCI area has not been a factor in inhibiting stocks from reaching minimum abundance levels. However, in recent years minimum escapements are not being met for wild steelhead. Exceptions include stocks that historically may have existed at small population sizes.
WSP Performance Standards:
Minimum Genetic Spawner Abundance: Greater than 600 wild summer steelhead and 750 wild winter steelhead, except for historically small populations in small streams.

(Abundance levels are based on the WSP spawner target of 3,000, divided by the average age of spawners.)

Phase 1 and Phase 2: Activities for this measure will essentially be the same as shown under DFW IIIA2.
Agency: WDFW Fish Management Program and co-managers
Timeline: 1998/99
Funding: Unknown; likely state
Contact(s): Guy Norman/Dan Rawding (360) 696-6211

DFW IA3. Develop hatchery operations plans for each hatchery program consistent with the WSP. These plans will include clear goals and objectives, specific operational components, risk management and monitoring and evaluation measures. Performance will be audited on a systematic basis (same as DFW IIIB11 and DFW IVA4).

Background: As a critical element in the implementation process for the WSP, production goals and operations will be reviewed for each hatchery in the LCSCI area. Where inconsistencies are identified, risk management measures will be identified and plans will be developed to rectify needed aspects. Hatchery production goals and adjustments will be annually reviewed and revised in the context of broader agency programming changes.

WSP Performance Standards: Specific hatchery operations plans will be developed consistent with WSP genetic conservation (DFW IA2, IA4, IA5) and ecological interaction standards (IVA2, IVA3), and meet criteria contained in the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Plans would identify the type and number of brood stock to be collected, the time frame for brood stock collection, spawning protocols, the number of smolts to be released, smolt release size and quality, smolt release time and location(s), and the disposition of carcasses for nutrient enhancement and recycling. Operational components will include adherence to strict disease detection and control protocols prior to hatchery releases. This would include federal hatcheries operated by USFWS.

Phase 1. Review production goals and operations for each hatchery in the LCSCI and develop hatchery operations plans following the prioritization framework in Chapter 12.
Agency: WDFW Hatcheries and Fish Management Programs
Timeline: Start 1998 (Tier 1 and 2)
Funding: State and federal
Contact(s): Manuel Farinas (360) 902-2683 and Dan Rawding (360)696-6211

Phase 2. Following an initial review of hatchery programs in the LCSCI area, issues and/or activities needing further planning, data collection, and/or funding will be identified and WDFW will seek funding commitments to accommodate them.
Agency: WDFW - Fish Management and Hatcheries Programs
Timeline: Starting 1999
Funding: Unknown; likely state and federal
Contact(s): Dan Rawding (360) 696-6211 and Manuel Farinas (360) 902-2683.

DFW IA4. Manage levels of gene flow from hatchery steelhead to ensure genetic conservation goals are met (e.g., via removal of hatchery fish at weirs/traps, acclimation/release, stocking level adjustments, cautious use of locally adapted wild steelhead in hatchery broodstocks).

Background: Determination of the level of gene flow from hatchery to wild steelhead normally requires estimation of relative percentages of wild and hatchery steelhead escapement levels (DFW IA6). WDFW currently uses various methods to obtain estimates or indices of wild steelhead escapements. These include redd, weir, and snorkel counts for wild winter stocks in the Kalama, Coweeman, NF Toutle, SF Toutle, upper Cowlitz, Tilton, Germany, Abernathy, Elochoman, Skamokawa, and Grays rivers. Similar information for summer steelhead stocks is obtained in the Wind and Kalama rivers. Index counts are available for summer steelhead in the Washougal and EF Lewis rivers and for winter steelhead in the EF Lewis, Washougal, and Green rivers. Spawner abundance estimates below dams on the NF Lewis and Cowlitz rivers are impossible to obtain using usual methods due to turbid water. Therefore, index counts for these areas are conducted in key tributaries used by wild steelhead such as Cedar Creek in the NF Lewis River and Olequa Creek in the Cowlitz River.

Escapements of hatchery steelhead are monitored using weirs in the NF Toutle and Kalama rivers, and in Trout Creek. Ratios of the abundance of hatchery to wild summer steelhead are monitored using snorkel surveys in the EF Lewis, upper Washougal, and Wind rivers. WDFW will seek to improve these surveys because they take place prior to spawning and there may often be a difference between the percentages of hatchery fish counted during snorkel counts and the percentages of hatchery fish that actually spawn. Hatchery spawner abundance estimates for the other stocks is based on expansions using data for Kalama River steelhead regarding data on hatchery smolt to adult survival, hatchery harvest rate, and expanded creel survey card returns.

To achieve genetic conservation goals, access by hatchery winter steelhead to production areas used by wild steelhead will be controlled using existing traps on the Kalama River and NF Toutle River, and for hatchery summer steelhead using existing traps on the Washougal (and the Kalama) River and Trout Creek. A cooperative agreement exists between WDFW and the USFWS to acclimate winter steelhead at the USFWS hatchery on Abernathy Creek, and to remove hatchery-origin adults there through the use of an electric weir. In addition, a partnership was established with volunteers, USFWS, PacifiCorp, and other partners to install a trap in Cedar Creek (Lewis River basin) at the

Grist Mill ladder in January 1998, to improve wild steelhead, cutthroat, and salmon abundance estimation capability and to restrict hatchery steelhead and sea-run cutthroat trout from entering natural production areas.

WSP Performance Standards:
Gene Flow: The surrogate measure of gene flow for each stock will be the percentage of hatchery spawners in the combined hatchery plus wild spawner aggregate. The maximum percentage of hatchery spawners for dissimilar stocks will be less than 1%, less than 5% for intermediate stocks, and less than 10% for similar stocks. Since the percentages of hatchery spawners for most stocks is over 30 to 50%, *WDFW has identified an interim target of reducing these percentages to 10% or less within 5 years.*

Phase 1: Since the percentages of hatchery spawners for most steelhead stocks in the LCSCI area is over 30%, current fisheries management and hatchery operations will be changed to reduce percentages of hatchery spawners. WDFW has committed to an interim target of reducing percentages of hatchery spawners to 10% or less within 5 years. In 1998, immediate actions will be taken in watersheds where hatchery adults can be excluded from wild steelhead production areas. *By the years 1999-2000, hatchery steelhead smolt plants will be reprogrammed consistent with levels that will achieve the 10% interim target for all stocks, assuming that funds will be available for development and operation of adult traps to remove hatchery fish after they have been exposed to the fishery (Phase 2).* Existing hatchery mitigation programs for the Cowlitz and NF Lewis Rivers will likely result in longer timelines, due to mitigation agreements mandated by FERC. Therefore, in those watersheds WDFW will identify key wild production areas and move toward meeting WSP performance standards in these specific areas. For example, the Cowlitz River above Cowlitz Falls and Cedar Creek tributary to the North Fork Lewis River would be high priorities.
Timeline: 1998-00
Funding: State, federal, private
Contacts: Guy Norman/Dan Rawding (360)696-6211; Manuel Farinas (360) 902-2683

Phase 2. By 2000/02, major hatchery steelhead smolt stocking level adjustments will have been programmed consistent with existing and expected trap operations and assessments of their effectiveness, and funding will be identified and secured for traps to be installed within the ensuing two years. By 2002, WDFW will have reviewed the potential for use of locally adapted brood stocks, and other major changes to hatchery strategies in the LCSCI area. In 2002, WDFW will complete a review clarifying the extent to which gene flow performance standards have been met. This will include a summary of outstanding trapping needs (i.e., traps identified but still needing funding). The summary will also outline conservation responses needed to achieve WSP performance standards in absence of identified funding (including identifying additional changes in stocking levels to achieve gene flow targets). The percentages of hatchery steelhead spawners in key wild production areas in the NF Lewis and Cowlitz Rivers will continue to be reviewed and reduced where possible to achieve WSP performance standards.

There are many strategies that will be explored, developed, and implemented to reduce risks associated with gene flow, but all have uncertainties and most will require additional funding to plan and implement. These include: removal of hatchery steelhead at weir/traps; improving homing of returning hatchery adults by acclimating hatchery juveniles at adult trap sites where returning adults can be removed; releasing hatchery smolts in lower river areas where overlap with wild steelhead spawning and abundance is low; reducing hatchery smolt stocking levels; and the cautious use of locally adapted wild steelhead in hatchery broodstocks. With the exception of removal of hatchery adults, the effectiveness of these strategies is generally uncertain and needs to be more fully evaluated to ensure that actions are appropriate to meet genetic conservation goals.

Specific activities proposed in individual priority watersheds are listed in Chapter 15.

Timeline: 2000/02
Funding: Unknown; likely state, federal, private; ***Initial portion requested in Governor Locke's 1999 state supplemental budget request.***
Contact: Dan Rawding (360) 696-6211 and Manuel Farinas (360)902-2683

DFW IA5. Manage harvest to ensure consistency with fishery selectivity guidelines (same as DFW IIIB7).

Background: For summer steelhead, WDFW implemented wild release regulations in the Wind River in 1982 and in all Columbia River tributaries in 1986. Wild steelhead release for winter steelhead was initiated in 1986 and all stream were in compliance by 1990. Fisheries will continue to be managed under wild steelhead release regulations and since there is no legal harvest in the sport fishery, WDFW assumes that fishery selectivity is not an issue. Currently, mortality rates for adult wild winter steelhead in lower Columbia tributaries are estimated to be 1% and 3%, and it is believed the mortality rate for summer steelhead may approach 10% in some basins.

In the mainstem of the Columbia River, treaty Indian and lower river commercial fisheries intercept wild steelhead. However, these fish cannot be retained and are released back into the river. In recent years these lower river fisheries have been reduced due to low spring chinook abundance and to protected listed Snake River salmon. Fisheries for sturgeon have continued with a minimum 9 inch mesh size to minimize salmon and steelhead impacts. Mesh size restrictions may be selecting for larger fish and the timing of these fisheries may also be subject to selection. All mainstem fisheries must be consistent with biological assessments and NMFS' biological opinions regarding harvest of listed species.

WSP Performance Standards:
Fishery selectivity: Harvest regimes will be oriented toward maintenance of stock characteristics similar to those of unfished steelhead stocks. Characteristics such as size, fecundity, spawning tine, age at maturity, and run timing will be monitored.

Phase 1. ODFW and WDFW have sampled lower river commercial sturgeon and salmon fisheries to determine incidental harvest and size of steelhead. Treaty Indian fisheries are also sampled. NMFS has funded WDFW to obtain genetic and biological samples at Bonneville Dam and in the Zone 6 fishery to determine genetic composition and affinity of harvest steelhead among ESUs. WDFW will recommend to TAC that an analysis for selectivity for all Columbia River fisheries be conducted. Based on the results of selectivity analyses performed in Phase 1, WDFW will make recommendations needed to manage fishery selectivity to maintain population characteristics similar to unfished wild steelhead populations.
Agency: WDFW and co-managers
Timeline: Start 1998; Recommendations starting 1999
Funding: State - federal
Contacts: Guy Norman/Dan Rawding/Cindy LeFleur/Chuck Tracy (360)696-6211

DFW IA6. Develop baseline and monitor biological and genetic parameters.

Background: Monitoring of genetic and biological parameters for steelhead stocks is essential to containing risks associated with conservation actions and related uncertainties, thus allowing detection of both desired and unintended consequences. This information is critical to maintenance of the long term productivity of wild steelhead populations. Data collected in this conservation measure will be used to assess compliance with conservation measures for Genetic Conservation (DFW IA1-7), Stock Abundance (DFW IIA1-3, IIB1-3), Harvest Impact (DFW IIIA1-4, IIIB1-11), Ecological Interactions (DFW IVA1-3), Predation (DFW VA1-2), Nutrient Enhancement (DFW VIA1-2). A detailed monitoring plan will be developed as part of the LCSCI (see Chapter 16 and Appendix 6 on monitoring). Biological parameters that need to be monitored include run size, escapement, smolt emigration, juvenile and adult distribution and age structure, age at maturity, run and spawning timing. These data are needed for both wild and hatchery steelhead stocks.

Biological Parameters

Phase 1. Monitoring of wild steelhead escapement by WDFW in both ESUs occurs primarily using redd surveys. At the Kalama Falls Hatchery, NF Toutle Fish Collection Facility, and Bonneville traps, monitoring of wild and hatchery escapement, adult age structure, length, sex ratios, routinely occurs and observations of marks made by marine mammals are recorded. In 1998, WDFW will add age structure monitoring of adult steelhead collected in traps in the Washougal River, Cowlitz River, NF Lewis River, Cedar Creek, and Trout Creek basins.
Smolt outmigrations will continue to be monitored at three sites in the Wind River watershed and at Mayfield and Cowlitz Falls Dams on the Cowlitz River. In past years smolt monitoring has been conducted on the Kalama and Toutle River; smolt monitoring is planned in those systems in 1998. Also in 1998, WDFW, PacifiCorp, and USFWS will fund a smolt outmigration study in Cedar Creek (Lewis River).

Timeline: 1998
Funding: State, federal, private
Contacts: Dan Rawding (360)696-6211 and Howard Fuss (360)902-2664

Phase 2. Additional funding will be sought to install an adult trap at the Shipherd Falls ladder to monitor the biological characteristics of Wind River steelhead. Modification of current facilities at Grays River, Elochoman River, Beaver Creek, and Skamania Hatcheries is proposed, to obtain additional biological information. It is anticipated that other new biological monitoring efforts would require substantial investment. Smolt monitoring should occur in areas where adult trapping facilities already exist so that smolt to adult survivals can be determined. Useful and cost-effective sites exist adjacent to the Kalama Falls Hatchery, Washougal Hatchery, and at the NF Toutle Fish Collection Facility. Proposals for Phase 2 activities will be consistent with monitoring needs and priorities established in Chapter 16 and Appendix 6..
Timeline: 1999 and beyond.
Funding: Unknown; ***Initial portion requested in Governor Locke's 1999 state supplemental budget request.***

Contact: Dan Rawding (360)696-6211

Genetic Parameters

Background: WDFW has established baseline genetic data for steelhead stocks in the Southwest Washington and Lower Columbia ESUs. Existing information is based on allozyme data generated from starch-gel electrophoresis performed primarily on juvenile steelhead/rainbow collections. Genetic sampling efforts by WDFW began in the 1980s and have continued to the present. Additional data will continue be collected at a considerably lower level of effort since initial WDFW sampling goals have largely been met.

Phase 2. Funding will be sought to fill data gaps and improve the allozyme database more rapidly, addressing key questions and testing assumptions underlying earlier analyses and interpretation. Priorities would include developing and applying methodologies based on non-lethal sampling techniques (e.g., DNA). Information from efforts utilizing DNA analyses is now being developed for steelhead. Given the limits of electrophoresis for non-lethal steelhead sampling , other techniques may become preferred if funding for development and baseline collections can be secured.
Timeframe: 1999 and beyond
Funding: Unknown
Contacts: Dan Rawding (360) 696-6211; Howard Fuss (360) 902-2664; Steve Phelps (360) 902-2771

DFW IA7. Establish refuges, or sanctuaries, where populations can be protected from genetic risks (e.g., where hatchery steelhead are not stocked, and other population pressures can be reduced/contained). (Related to DFW IIIB6).

Background: Refer to Chapter 13 for more information on the concept of sanctuary or reserves areas as applied to the LCSCI. Briefly, for fish management these areas are intended afford a high degree of protection to wild stocks, and form a network of areas used by wild steelhead, within which hatchery steelhead are not stocked or are precluded from access. The number, type, and extent of fish management reserve or sanctuary areas in the LCSCI area will be reviewed and revised, as appropriate. Sanctuaries are an important element for genetic risk management, since they protect the genetic diversity of steelhead populations within them. Fish management sanctuary areas currently exist for winter steelhead in Mill Creek, the NF Toutle River, and five small Columbia River tributaries. In 1997, a sanctuary area for winter steelhead was adopted for Cedar Creek (Lewis River). A sanctuary for summer steelhead exists in Trout Creek, a tributary to the Wind River.

Phase 1. Additional scoping and public involvement will be conducted to explore development of priority candidate sanctuary waters (entire basins and or portions of basins). Candidates include Skamokawa Creek, Germany Creek, EF Lewis River, SF Toutle River, and Grays River. Hatchery steelhead would not be stocked in high priority sanctuary areas. In basins where the upper water is designated as a sanctuary area, the release of hatchery smolts might be allowed as long as returning hatchery adults would be totally excluded (using trapping facilities) from entry into the area. Opportunities will be pursued where trapping capability exists or can be developed. Current candidates exist at fish ladders on the upper Washougal River at the Washougal Salmon Hatchery, the NF Washougal River at the Skamania Hatchery, the Kalama River at the Kalama Falls Hatchery, and the Wind River at Shipherd Falls. Additional opportunities for sanctuary waters in upper watershed areas exist in the Elochoman River at Elochoman Hatchery, Abernathy at Abernathy Hatchery, Grays River at Grays River Hatchery, and Salmon Creek above Klineline Pond. Where enclosure capability is not feasible, and needs for additional sanctuary areas exist, options will be outlined that include elimination of hatchery smolt releases. Consistent with the prioritization framework in Chapter 12, sanctuary or reserve areas for wild summer steelhead stocks will be rigorously examined.
Timeline: Start 1998
Funding: State - federal
Contacts: Guy Norman/Dan Rawding (360)696-6211; Steve Phelps (360)902-2771

Phase 2. Implement new sanctuary areas identified in Phase 1. Some new areas could be implemented and/or continued without additional funding. However, in most areas where only upper watersheds are identified as sanctuaries, additional funding would be needed to modify existing trapping facilities and to hire staff to operate traps. Where entire basins are designated sanctuaries, no additional funding is needed since hatchery releases would be eliminated.
Timeline: 1998 and beyond

Funding: Unknown;
Contact: Dan Rawding (360) 696-6211

Monitoring:
Many components of these conservation measures are amenable to monitoring (see Chapter 16 - Monitoring and Evaluation, and Appendix 6). Monitoring components are currently largely under the auspices of WDFW, but would increasingly involve multiple agencies and partners.

Further work will include:
Assess development and management of conservation goals

Develop and implement hatchery operations plans.

Monitor parameters for gene flow, spawner abundance, and fishery selectivity elements, e.g.,:
- annual % hatchery steelhead at key/index sites
- annual wild steelhead escapement estimates
- size/age distributions at weir/trap site

Monitor genetic and biological characteristics of stocks at key/index sites consistent with WSP:
- Update SASSI
- Genetic diversity assessments (GDU updates), and other genetic traits
- spawning and rearing distribution
- life history traits
- habitat associations

Tracking annual harvest/regulation management processes; re-negotiated Columbia River Fish Management Plan

Relationships to the Steelhead Supplement to the Oregon Plan (SSOP):
Most LCSCI conservation measures for this factor are similar to those in the SSOP.

Bi-state coordination needs include pursuing integration of monitoring and evaluation planning, implementation, data analyses, and reporting of results (e.g., trends in stock status, straying, life history, genetic diversity).

Factor for Decline:

II. <u>Stock Abundance at High Risk of Extinction or Not Sustaining</u>

Stock status may be depressed to such low densities that insufficient numbers of spawners return to replace themselves in the next generation. Mechanisms for this include inbreeding depression, poor mate selection, and other factors. In these circumstances, higher levels of human intervention may be deemed necessary to prevent extinction or to increase production to at least minimal levels.

Biological Objective:

A. Restore population sizes to minimum levels.

It is important for wild steelhead stocks to maintain themselves, especially at low population sizes. Maintenance in this case is defined as one spawner that produces at least one returning adult spawner, at population sizes consistent with genetic guidelines. When stock abundance falls too low, stocks are not able to replace themselves and risks of extinction increase. As wild steelhead populations get smaller the risk of loss of both local adaptation and genetic diversity increases. Smaller, less diverse populations are more sensitive to environmental changes, ecological factors, and other impacts and thus the extirpation of entire unique populations is more likely.

Conservation Measures:

DFW IIA1. Identify candidate stocks at risk and analyze factors limiting production and perform risk assessments.

Background: All wild steelhead stocks in the LCSCI area will be examined and those that fall below minimum spawner/genetic abundance thresholds and thus are unable to replace themselves will be identified. Sequencing of activities will follow the prioritization framework in Chapter 12. Risk assessments and some form of limiting factors analysis will be performed on these stocks. Population viability analyses will be performed to complement risk analyses. Priorities for action alternatives will be established based on limiting factors analysis and risk assessment. This action is related to similar assessments outlined in subchapter 2 of this chapter regarding habitat.

Phase 1. WDFW is cooperating with partners in a restoration effort in the Wind River that is currently pursuing use of such analytical tools.
Timeline: Wind River - 1999
Funding: State - federal
Contact: Dan Rawding (360)696-6211

Phase 2. Other risk assessments will be conducted as time and funding become available following the order of priority tiers in Chapter 12.
Timeline: 1998/99; other Tier 1 and 2 - 2001; winter -run stocks 2003
Funding: Unknown
Contact: Dan Rawding (360) 696-6211

DFW IIA2. Develop and implement supplementation, captive rearing, or other appropriate interim hatchery strategies as means to achieve biological objectives.

Background. Hatchery strategies geared toward stock rebuilding and restoration may have utility in restoration plans. However, the efficacy of such strategies is largely

unknown in terms of genetic and ecological risks and long term sustainability of recipient wild stocks. Supplementation, captive brood stock, and other hatchery intervention programs have been applied to conserve anadromous salmonids at risk (e.g., Snake River fall chinook and sockeye). However, there are risks associated with these programs.

Phase 1. WDFW will continue to review and identify candidates where hatchery strategies may be applied to achieve restoration objectives and detailed risk management plans and approaches will be designed. At this time candidates for implementation of supplementation or local broodstock strategies include Kalama and Wind River summer steelhead. An effort to reintroduce winter steelhead above Cowlitz Falls (upper Cowlitz River) is now ongoing.
Timeline: Wind and Kalama River - 1998
Funding: State and federal
Contact: Dan Rawding (360)696-6211; Steve Phelps (360) 902-2771; Howard Fuss (360)902-2664

Phase 2. WDFW will work cooperatively with other fisheries agencies to expand ongoing hatchery intervention strategies to develop and explore supplementation programs, captive rearing, or other appropriate interim strategies as a means to achieve a biological objectives.
Timeline: 1999 and beyond
Funding: Unknown
Contact: Dan Rawding (360) 696-6211; Steve Phelps (360) 902-2771; Howard Fuss (360)902-2664

DFW IIA3. Assess effectiveness of supplementation and other hatchery strategies in terms of risk containment and rebuilding objectives.

Background. Hatchery strategies associated with steelhead restoration efforts should be considered largely experimental due to critical uncertainties associated with various risks and benefits. WDFW will pursue implementation of priority evaluations related to the use of local broodstocks.

Phase 1. A rigorous experimental design and risk management plan will be prepared as part of an evaluation of local summer steelhead brookstock in the Kalama River. Other candidates for evaluation of supplementation or other hatchery strategies will also be identified.
Timeline: 1998-2010
Funding: State and federal
Contacts: Dan Rawding (360)696-6211; Pat Hulett (360) 577-0197 and Howard Fuss (360)902-2664

Phase 2. Funding to design and expand priority evaluation efforts beyond those described for Phase 1 will be sought.
Timeline: 1998 and beyond

Funding: Unknown
Contact: Pat Hulett (360) 577-0197, Bill Hopley (360) 902-2749; Howard Fuss (360)902-2664

Biological Objective:

B. Restore appropriate stocks where previously extirpated.

Conservation Measures:

DFW IIB1. Identify and prioritize candidate stocks suitable for reintroduction efforts.

Background. Reintroduction of steelhead in order to produce wild self sustaining runs of steelhead will help protect the genetic diversity and long-term productivity of wild steelhead within and between ESUs. By increasing the numbers and diversity of wild steelhead extinction risks are lessened.

Phase 1. WDFW has begun to identify and prioritize candidate stocks suitable for reintroduction efforts. In 1992, WDFW, BPA, Tacoma Public Utilities, USFWS, USFS, and other partners initiated a steelhead reintroduction effort in the upper Cowlitz and Cispus Rivers (for an overview see Appendix 7). Through the FERC relicensing process the feasibility of steelhead reintroduction efforts in the Tilton and upper North Fork Lewis rivers will be explored.
Timeline: 1998-2008
Funding: State, federal, private
Contact: Guy Norman/Dan Rawding (360) 696-6211

Phase 2. Candidates for restoration will continue to be examined and appropriate action priorities will be developed pending availability of funds. WDFW supports fish reintroduction above Condit Dam to restore wild steelhead populations to the White Salmon River. Although NMFS has included the White Salmon River in the Middle Columbia River steelhead ESU, WDFW expects benefits would accrue to the Lower Columbia ESU associated with reduction of genetics risks associated with known straying between rivers in these adjacent ESUs.
Timeline: 1998 and beyond
Funding: Unknown
Contacts: Craig Olds (360) 902-2540, Curt Leigh (360) 902-2422; Guy Norman (360)696-6211

DFW IIB2. Identify factors limiting production and develop plans to address them.

Background. Reintroduction programs can only be successful if plans identify the factors that caused expatriation and the factors that would limit successful reintroduction. Monitoring and evaluation are important components of these plans so that limiting factors can best be addressed.

Phase 1. WDFW will continue to provide input to BPA for the development of a Cowlitz Falls reintroduction plan that effectively addresses the factors most limiting wild steelhead production in the upper Cowlitz River watershed, fish passage. Similarly, WDFW will work in the FERC process to assist and request that analyses of factors limited production be performed to determine the feasibility of reintroductions.
Timeline: Ongoing
Funding: State, federal, private
Contacts: Guy Norman/Dan Rawding (360)696-6211; Jack Tipping (360)902-2661

Phase 2. Draft plans for salmon and steelhead reintroduction on the White Salmon River were developed by fisheries agencies and tribes through the Columbia Basin Fish and Wildlife Authority.
Timeline: 1998-2008
Funding: Unknown
Contact: Craig Olds (360) 902-2445

DFW IIB3. On a priority basis, implement reintroduction strategies using the most appropriate hatchery or wild donor stock and rigorous risk management and evaluations.

Background: Reintroduction plans that result from the preceding conservation actions will need to be implemented using appropriate stocks and risk management actions. This measure pertains to implementation of identified actions.

Phase 1. A partial reintroduction effort in the upper Cowlitz program has begun, but federal budgetary support for it has recently been reduced, threatening the success/continuation of the program. Currently, most available funds are used to operate the fish passage facility with little funds available for natural production, strategy effectiveness evaluations, or compliance monitoring. In order to develop and maintain a successful program more funding is required to test a variety of reintroduction strategies and to use an adaptive management approach in these efforts. WDFW will continue to pursue such funding and will prioritize other candidate strategies for implementation.
Timeline: Ongoing
Funding: Federal, state, private
Contacts: Dan Rawding (360) 696-6211; Jack Tipping (360) 902-2661

Phase 2. Additional funding will be required to implement new reintroduction strategies using the most appropriate stocks, and to develop rigorous risk management and evaluation projects. Feasibility studies will be conducted to assess whether candidate restoration projects are viable and practical means to address factors limiting production. To that end, WDFW may request additional funding through the FERC relicensing process in the NF Lewis and Cowlitz rivers. WDFW has already requested funding for White Salmon River reintroduction.
Timeline: 1998-2008

Funding: Unknown
Contacts: Craig Olds/Curt Leigh (360) 902-2946, Charles Morrill (360) 753-3009

Monitoring:

In general, monitoring parameters for Objective A would be similar to those described under Factor for Decline I. For Objective B, procedures will be developed and actions will include review, analysis, and development of stock-specific limiting factor, risk management, implementation, and evaluation plans as appropriate. These components will be integrated into watershed-based rebuilding/reintroduction plans and evaluations.

Relationships to SSOP:

Most LCSCI conservation measures for this factor are similar to those in the SSOP.

Bi-state coordination needs include timely development and sharing of evaluation findings to assess the efficacy of restoration/supplementation actions and risk containment approaches.

FISHERIES

Factor for Decline:

III. Harvest Impacts On Wild Steelhead

Adequate numbers of wild steelhead spawners are a key requirement for sustainable wild production. Fisheries can influence the abundance of steelhead that escape to spawn. At the present time it is illegal to retain wild steelhead in sport fisheries but indirect mortality can occur in these and other fisheries.

Biological Objective:

A. Ensure wild spawner escapements are adequate for stock maintenance at healthy, sustainable levels, compatible with available spawning and rearing habitat.

Conservation Measures:

DFW IIIA1. Review and as needed, revise wild steelhead spawner escapement goals for each stock.

Background: Escapement goals for wild steelhead stocks are established by WDFW using a maximum sustainable yield approach relying on a habitat based model developed in the 1980s (Gibbons et al 1985). In the Southwest Washington ESU, escapement goals exist for wild winter steelhead stocks in the Grays River, Skamokawa Creek, Elochoman River, and Abernathy and Germany creeks. Summer steelhead spawner escapement goals

have been developed in the Lower Columbia ESU for Trout and Panther creek, and Wind and Kalama river stocks. Escapement goals have also been established for wild steelhead in the upper Cowlitz, SF Toutle, Coweeman, and Kalama rivers. Index escapement goals have been established for stocks in the EF Lewis and Washougal rivers, but methodologies could be improved.

WSP Performance Standard: Establish escapement goals for all wild steelhead stocks.

Phase 1. In the Lower Columbia ESU, preliminary escapement goals have been established for wild summer steelhead in the NF Washougal, mainstem Washougal, and EF Lewis rivers. These preliminary goals will be field checked during the summer of 1998. The remaining summer steelhead stock in this ESU for which an escapement goal is needed is in the NF Lewis River. Since most of the historical spawning area for this stock was blocked by creation of Merwin Dam in 1931, plus the fact that the river has been heavily stocked with hatchery steelhead, WDFW will propose to change the stock composition designation to hatchery/wild in the future update of SASSI (WDF et al. 1993).

Index goals for wild winter steelhead in the Lower Columbia ESU have been expanded into preliminary escapement goals for the EF Lewis and Washougal rivers. Preliminary escapement goals have also been established for Cedar and Salmon creeks. In 1998, escapement goals will be developed for winter-run stocks in the Green, NF Toutle, lower Cowlitz, and NF Lewis rivers.

A wild winter steelhead spawner escapement goal will be developed for the Mill Creek stock in the Southwest Washington ESU. Accomplishment of that task will complete the process for all steelhead stocks in that ESU.
Timeline: 1998
Funding: State
Contact: Dan Rawding (360)696-6211

Phase 2. In most cases escapement goals based on maximum sustainable yield are larger than the minimum spawner abundance needed for genetic conservation (600-750 spawners per stock, depending on the average age of spawners). Pending agency review and analysis, WDFW will develop a three-tiered approach to establishing escapement goals including a conservation, maximum sustainable yield, and maximum carrying capacity components. Where both summer and winter stocks coexist in the same watersheds, analyses will include approaches to view wild escapement goals in the composite.
Timeline: Unknown
Funding: Unknown
Contacts: Dan Rawding (360) 692-6211

DFW IIIA2. Manage escapements of wild steelhead spawners to ensure spawner escapement goals are met or exceeded.

Background. Adequate numbers of wild steelhead spawners are a key requirement for sustainable wild production. Fisheries can influence the abundance of steelhead that escape to spawn. Wild summer steelhead release sport fishing regulations were implemented in the Wind River in 1982 and for all Columbia River tributaries in 1986. Wild steelhead release regulations for winter steelhead followed in 1990. Sport fisheries will continue to be managed using wild steelhead release. Adult mortality rates for wild winter steelhead in lower Columbia tributary sport fisheries currently are estimated to be 1% to 3%. In the mainstem of the Columbia River Indian Treaty and lower river commercial fisheries intercept wild steelhead. In recent years these lower river fisheries have been reduced due to low spring chinook abundance. Fisheries for sturgeon have continued with a minimum 9 inch mesh size to minimize salmon and steelhead impacts. The current estimated wild winter steelhead mortality rate in the Columbia River commercial fisheries 1%. All fisheries will be managed consistent with ESA biological assessments and NMFS biological opinions for listed species.

WSP Performance Standard: WDFW has proposed that stocks not meeting agency-established spawner escapement goals, shall be managed no more than a 10% harvest rate on those stocks as measured in adult equivalents. When stock abundance falls below minimum spawner abundance levels (e.g., 600-750 for steelhead), WDFW will seek to lower the acceptable incidental harvest rate.

Phase 1. WDFW will develop mortality rate estimates for mainstem Columbia River and tributary summer steelhead sport fisheries. WDFW will continue to work with co-managers to identify and avoid adverse impacts to wild steelhead in sport, Treaty Indian, and non-Indian commercial fisheries.
Agency: WDFW and co-managers
Timeline: 1998
Funding: State
Contacts: Guy Norman/Dan Rawding (360) 696-6211
Phase 2. Adult wild summer steelhead escapement estimates will be refined after a more focused assessment of more detailed and specific information on catch and release mortality and wild steelhead interception rates. With additional funding support, acquisition and analysis of new information on juvenile wild steelhead handling rates and catch and release mortality rates associated with juvenile steelhead in trout fisheries will be developed.
Timeline: 1998 and beyond
Funding: Unknown
Contact: Dan Rawding (360) 696-6211

DFW IIIA3. Develop and assess abundance predictors in index streams.

Background. The abundance of steelhead stocks is influenced by variable freshwater and marine conditions. This variability makes it difficult for fish managers to develop accurate and reliable abundance predictors for management and stock assessment purposes. A need therefore exists to develop effective abundance predictors for steelhead stocks.

Over the longer term, WDFW's intent is to develop a model using run reconstruction techniques to forecast run sizes. In addition, the assessment of changes in freshwater survival will improve abilities to assess factors for decline, recovery responses, assess effects of changes to freshwater habitat parameters, and monitor responses to changes in fish management practices. Examination of relationships between estimates of smolt to adult survival in the LCSCI area above vs. below Bonneville dam will also allow a cursory assessment of trends in mainstem passage conditions. Representative steelhead stocks within each ESU will be considered as index stream candidates.

Phase 1. WDFW proposes to initiate development of an index-based abundance prediction approach that would use estimates of annual adult run size, escapement, and abundance of smolt outmigrants.

An interim approach will be outlined using available data sources. Issues needing further resolution and development in order to achieve a statistically sound predictor model will be identified. Components of existing databases include those elements that were described for measure DFW IA6.

Estimates of total escapement or escapement indices for all major stocks will be considered with the exception of the lower Cowlitz and NF Lewis rivers. Ongoing monitoring of smolt outmigration in the Wind River will be continued. Cooperative assessment efforts in the Wind River have occurred between WDFW, USFS, USFWS, and the Yakama Indian Nation. This process has resulted in estimation of adult escapements since the 1984-85 return cycle, for smolt outmigrant abundance estimates since 1995 in the mainstem Wind River, Trout Creek and Panther Creeks. In 1998, WDFW will work with partners to develop a smolt monitoring and adult trapping capability in Cedar Creek (Lewis River).
Timeline: 1998/99
Funding: State, federal
Contact: Dan Rawding (360)696-6211

Phase 2. This phase will include requests for needed funding for refinement and implementation of the modeling approach and for the implementation of improved smolt outmigrant monitoring capabilities. Information on steelhead smolts has been obtained intermittently from Kalama and NF Toutle river steelhead. Adult trapping facilities are present in both of these rivers and developing effective and continuous smolt trapping capability will likely be a high priority. Funding will be sought to develop smolt sampling capabilities for a priority list of additional stocks/sites consistent with identified modeling

needs, coupled with multi-species assessment benefits.
Timeline: 1998 and beyond
Funding: Unknown;
Contacts: Dan Rawding (360) 696-6211 and Pat Hulett (360) 577-0197

DFW IIIA4. Develop baseline and monitor biological and genetic parameters.

This measure is the same as DFW IA6. ***[Initial portion of Phase 2 funding requested in Governor Locke's 1999 state supplemental budget.]***

Biological Objective:

B. Reduce harvest-related impacts on wild steelhead.

Conservation Measures:

DFW IIIB1. Continue to mark all hatchery steelhead.

Background. By 1984, WDFW had mass marked all hatchery summer steelhead smolts released above Bonneville Dam in cooperation with other Columbia River fishery managers. Over the ensuing few seasons the marking program was expanded to include all Columbia River steelhead and cutthroat releases. Mass marking continues to provide a mechanism to manage for selective harvest of hatchery steelhead while affording protection to wild steelhead stocks.

Phase 1. Continue to mass mark all hatchery steelhead prior to smolt release to enable focused harvest of hatchery fish while allowing wild steelhead to be released.
Funding: State, federal, private
Timeline: Task complete/ongoing
Contact: Manuel Farinas (360) 902-2683

DFW IIIB2. Maintain selective harvest sport fisheries on hatchery steelhead.

Background. Since all hatchery steelhead released for harvest augmentation will continue to be fin clipped, selective fisheries can be maintained as long as hook and release mortality to wild steelhead resulting from those fisheries is consistent with wild steelhead protection and rebuilding objectives. WDFW has used such strategies as differential run time between hatchery and wild fish, lower river smolt releases, acclimation facilities, and recycling hatchery fish to the lower river to maintain segregation of hatchery from wild fish and to harvests in fisheries.

Phase 1. Continue stocking hatchery steelhead in the lower portions of Southwest Washington and Lower Columbia River tributaries. Maintain selective harvest opportunity on the Lower Cowlitz and NF Lewis Rivers consistent with FERC mitigation agreements that require on-site mitigation for steelhead losses caused by dams. Provision of harvest

opportunity in other basins will be consistent with genetic conservation standards in the WSP and genetic conservation measures in the LCSCI. Options to create improved harvest opportunities consistent with wild stock protection goals (e.g., via recycling) will be identified and prioritized, and to the extent possible, implemented early (e.g., Kalama and Washougal rivers); others will be identified for later implementation under Phase 2.
Timeline: Task is complete and ongoing.
Funding: State and federal
Contacts: Dan Rawding/John Weinheimer (360)696-6211

Phase 2. To maintain a high level of harvest opportunity increased funding will be pursued for capture/recycling of returning hatchery adults, and for pre-release smolt acclimation facilities. Specific priorities and implementation plans will be developed from planning efforts in Phase 1.
Timeline: 1998 and beyond
Funding: Unknown
Contacts Dan Rawding (360) 696-6211; Manuel Farinas (360) 906-2683

DFW IIIB3. Manage trout fisheries to reduce mortality on juvenile steelhead.

Background. Although protective minimum size and time regulations are in place, mortality to juvenile steelhead can occur in fisheries targeting trout. WDFW will continue to modify trout management strategies to reduce the impacts of fisheries-related mortalities on juvenile salmonids. With one exception in the LCSCI area (i.e., sea-run cuthroat trout) hatchery trout are not released into anadromous waters and thus angler related mortalities associated with such fisheries targeting hatchery trout are not present. Harvest regulations for trout (8 inch minimum size) may help remove residual hatchery steelhead.

WSP Performance Standard: WDFW has proposed that for stocks not meeting agency-established spawner escapement goals, there shall be no more than a 10% harvest rate on those stocks as measured in adult equivalents. Juvenile steelhead mortality will be adjusted to adult equivalents. When stock abundance falls below minimum spawner abundance levels (e.g., 600-750 for steelhead), WDFW will seek to lower the acceptable incidental harvest rate.

Phase 1. WDFW's basic stream management strategy in the LCSCI area includes the following strategies to protect wild steelhead: (1) opening day for trout fishing in streams is delayed until June 1 to afford a high level of protection for outmigrating salmon, steelhead, and sea-run cutthroat trout smolts; (2) year around stream closures are used in certain natural production areas to protect steelhead from harvest, including substantial portions of the Grays, Toutle, Kalama, EF Lewis, and Washougal rivers; (3) waters are designated where it is legal to fish only for steelhead, where fishing for trout and/or steelhead juveniles is prohibited (i.e., Toutle and Grays rivers); (4) bag limits include a two fish limit for trout with an 8 inch minimum size during the trout fishing season in all streams, and additional protection is afforded in larger rivers wherein a 12 inch minimum

size limit is used; (5) the catchable trout program, using stocked hatchery trout, is focused in non-anadromous waters; and (6) and education/outreach program is continued and increased to educate the public on the need for and existence of restrictive trout regulations using means such as signage, news releases, angler contacts, and public meetings.

WDFW will continue to consider modifications in trout fishery regulations and programs to increase protection to wild steelhead stocks at risk where angler-induced mortality to juvenile steelhead indicates changes are needed. Strategies could include time/area closures, gear type restrictions, and bag limit reductions. Public education, outreach, and enforcement programs will be reviewed and modified to increase their focus on the need to inform anglers and protect juvenile steelhead. Cramer (1997) indicated that the greatest harvest of wild steelhead in the last decade may be the juvenile wild steelhead caught in trout fisheries. The survival of juvenile steelhead after being caught and released on bait can be a significant source of mortality that WDFW will examine in DFW IIIB4.
Timeline: 1998 and beyond
Funding: State
Contact: Dan Rawding (360) 696-6211

DFW IIIB4. Develop hook and release mortality estimates for juvenile and adult steelhead.

Background. WDFW utilizes selective fishing regulations to offer harvest opportunities while protecting wild juvenile and adult steelhead by requiring anglers to release unmarked fish. However, all released fish do not survive the hook and release process nor do all anglers comply with fishing regulations, whether inadvertently or purposefully. To calculate sportfishing mortality rates for adult and juvenile steelhead, rates of fishery interception and catch and release mortality are needed. WDFW feels data are currently sufficient for calculation of reliable winter steelhead sport fishing mortality estimates, but data for such estimates for summer steelhead and juvenile sport fishing are not and need to be improved with additional data.

WSP Performance Standard: WDFW has proposed that for stocks not meeting agency-established spawner escapement goals, there shall be no more than a 10% harvest rate on those stocks as measured in adult equivalents. When stock abundance falls below minimum spawner abundance levels (e.g., 600-750 for steelhead), WDFW will seek to lower the acceptable incidental harvest rate.

Phase 1. Due to differential run timing between hatchery and wild winter steelhead the angler interception rates range from 0% on streams closed to angling, to 15% for streams that close to fishing on March 15, to 40% for streams that remain open through June 1. Current studies indicate hooking mortality rates for winter steelhead specifically, are less than 5% in most cases. Due to low hooking mortality and interception rates, WDFW estimates that the current winter steelhead sportfishing mortality rate is less than 3% on year around streams and less than 1% on streams that close on March 15. Although

limited data are available, WDFW will review available information, consult with other fishery managers (i.e., Oregon), and develop initial estimates of wild adult summer steelhead and juvenile steelhead sport fishing mortality.
Timeline: 1998/99
Funding: State, federal
Contacts: Dan Rawding/John Weinheimer (360) 696-6211

Phase 2. Depending upon the outcome of Phase 1 activities, WDFW will cooperate with ODFW, IDFG, and others to improve the information base upon which to estimate summer steelhead hooking mortality and interception rates including the effects of parameters such as water temperature, gear type, effect of multiple encounters, distance to spawning grounds, and elapsed time from hooking to spawning. Cramer (1997) indicated that the greatest harvest of wild steelhead in the last decade may be the juvenile wild steelhead caught in trout fisheries. The survival of juvenile steelhead after being caught and released on bait can be a significant source of mortality. WDFW will also cooperate with other entities to better define, measure, and evaluate parameters effecting juvenile steelhead hooking mortality.
Timeline: 1998 and beyond
Funding: Unknown
Contact: Dan Rawding/John Weinheimer (360) 696-6211

DFW IIIB5. Manage tributary and mainstem fisheries (all species) to reduce incidental harvest of wild steelhead.

Background. Commercial sales of steelhead are prohibited and there are no targeted commercial steelhead fisheries in the LCSCI area. However, adult wild steelhead utilize the Columbia River year around, and existing fisheries may impact these fish. Commercial salmon fisheries have been modified in recent years to limit their impacts on wild steelhead to less than 1% of the summer and winter steelhead runs. However, the influence of these fisheries on specific steelhead stocks or ESUs are unknown. Commercial salmon seasons have been timed to maximize ratios of salmon to steelhead in the catch and have changed from 8 to 9 inch mesh. These modifications have reduced the proportion of steelhead handled by about a third. Changes were imposed on fishing gear used to harvest shad in 1995 and 1996 to reduce the number of salmonids handled. All fisheries will be managed consistent with biological assessments and NMFS' biological opinions for listed species.

WSP Performance Standard - WDFW has proposed that for stocks not meeting agency-established spawner escapement goals, there shall be no more than a 10% harvest rate on those stocks as measured in adult equivalents. Juvenile steelhead mortality will be adjusted to adult equivalents. When stock abundance falls below minimum spawner abundance levels (e.g., 600-750 for steelhead), WDFW will seek to lower the acceptable incidental harvest rate.

Phase 1. WDFW will work with other co-managers to reduce the bycatch of wild steelhead in lower Columbia fisheries. These fisheries will be continue to be monitored to determine steelhead handling rates. WDFW will seek to manage fisheries under the auspices of the US vs. Oregon agreement in a manner consistent with the intent of the Columbia River Fish Management Plan to provide harvest opportunity and rebuild depressed stocks of wild steelhead. WDFW will collaborate with NMFS in a genetic evaluation and monitoring program to estimate run sizes of steelhead of different ESUs as they pass Bonneville Dam, and to sample fisheries to estimate harvest for different ESUs. The results of this effort have the potential to provide appropriate guidance for restructuring of fisheries to minimize harvest impacts on wild steelhead in the LCSCI area. WDFW will continue to manage steelhead fisheries conservatively, consistent with variations in wild stock health and abundance trends. Sharp declines or other indicators of risk will warrant measures to reduce incidental mortality of wild steelhead. Such measures have recently been taken to reduce potential impacts to declining wild summer steelhead stocks in the LCSCI area (See Appendix 3).
Agency: WDFW and co-managers
Timeline: 1998 and beyond
Funding: State and federal
Contacts: Guy Norman/Dan Rawding (360)696-6211

Phase 2. Depending upon the results of Phase 1 efforts, more effort may need to be placed on designing and implementing effective harvest measures to protect wild steelhead. In addition, funding would be sought as appropriate, to expand wild steelhead genetic sampling programs and design rigorous monitoring approaches to improve estimation of fishery impacts on wild steelhead stocks and/or ESUs in the LCSCI area.
Agency: WDFW and co-managers
Timeline: 1999 and beyond
Funding: State and federal
Contact: Guy Norman/Dan Rawding (360) 696-6211

DFW IIIB6. Identify and designate sanctuary areas to protect wild steelhead from angling. (Related to DFW IA7).

Background. The purpose of fish management sanctuary areas under this measure is to provide a refuge for wild steelhead before, during, and after spawning, thus affording the greatest level of certainty that genetic integrity, biological diversity, and other unique qualities would be conserved with the least risk to stock health and long-term productivity as a result of human factors (see also Chapter 13). To that end it would be appropriate to view these waters as a network or core populations locate through out each ESU that would conserve a representative spectrum of the existing steelhead diversity and provide risk insurance and a means to encourage recovery of like history and genetic diversity that may have already been lost. As a minimum these waters should include populations displaying unique genetic characteristics, size and age distribution, abundance, and populations that can assess areas above falls that are barriers to other anadromous salmonids.

Fishing will be consistent with the concept of sanctuary waters as long as stock abundance is high, or low but increasing, and resulting harvest does not impose selective pressures on the resource. This presumes that fishing would also be consistent with NMFS guidelines regarding "direct take" of listed species. Fishing would not be a compatible activity where stock status is critically low or precipitously declining. Since the mid-1980s, stock status concerns for wild steelhead in the LCSCI area have lead to imposition of wild steelhead release regulations where legal harvest of wild steelhead is precluded. The sanctuary concept under this measure will afford higher levels of protection for pre-spawners, spawners, and post-spawning kelts from angling impacts. To delineate candidates for sanctuary water status, WDFW will review stock status information on depressed or vulnerable populations, critical times and areas for steelhead adults and juveniles, and the need for directed protection for wild steelhead at critical times (see also Chapter 13).

Phase 1. Various areas among and within rivers have been closed to fishing to afford protection to both adults and juveniles. Some of the first sanctuary or reserve areas were delineated in the 1950s in the upper Washougal and Kalama rivers to protect pre-spawning wild adult summer steelhead. In later years a protective area for summer steelhead was designated in the upper EF Lewis River. At the present time, three of the four wild summer steelhead rivers have substantial areas where summer steelhead are protected from harvest.

After the eruption of Mt. St. Helens in 1980 large sections of the Toutle River were closed to fishing to protect winter steelhead, sea-run cutthroat, and salmon. Currently, all tributaries of that system are closed to fishing; angling in the mainstems of the Green and NF Toutle rivers is available only to adult hatchery summer steelhead and salmon angling, and the lower portion of the SF Toutle River is open through March 31 under wild steelhead release regulations. The Grays River is closed to trout fishing.

Compared to wild summer steelhead wild winter steelhead typically spend a limited the amount of time in freshwater as adults. Therefore, sanctuary areas to protect wild adult winter-run can be focused during a specific time interval. The greatest need for protection occurs from March through May. This strategy is now used extensively to protect about 70% of each wild winter steelhead stock's return from angling. With a few exceptions, WDFW has used this modified sanctuary area concept to all steelhead stocks in the Southwest Washington and Lower Columbia ESUs.
Timeline: Task completed/ongoing
Funding: State
Contacts: Guy Norman/Dan Rawding (360)696-6211

Phase 2. WDFW will continue to identify the need for additional fish management sanctuary/reserve areas for wild steelhead stocks in the LCSCI area. WDFW will develop criteria such as population vulnerability, genetic characteristics, size/age distribution, abundance, run and spawning timing, and population access to areas above falls to delineate additional sanctuary areas. See DFW IA7.

Timeline: 1998 and beyond
Funding: Unknown
Contact: Dan Rawding (360) 696-6211

DFW IIIB7. Manage steelhead harvest to ensure consistency with fishery selectivity guidelines.

This measure is the same as DFW IA5.

DFW IIIB8. Develop enforcement plans to increase emphasis on wild steelhead protection and angler compliance with wild steelhead release regulations.

Background. Existing habitat and fishery regulations were adopted to protect wild steelhead and their habitat. Enforcement of the state's Hydraulic Code is will protect steelhead habitat. The illegal harvest of wild steelhead adults and juveniles is a potentially high source of steelhead mortality. Illegal harvest takes place may be done willing by those retaining wild fish or unwillingly by those who are unaware laws requiring the release of wild steelhead. A strong WDFW enforcement presence will deter such activities.

Phase 1. WDFW's Fish Management, Habitat, and Enforcement Programs will coordinate to increase the enforcement of regulations that protect wild steelhead and their habitat in the LCSCI area. Internal annual and quarterly coordination meetings will be used to review compliance with existing regulations and establish priorities for fishery and habitat monitoring. As part of the fishery monitoring program, angler compliance with wild steelhead release and juvenile steelhead protection will be emphasized, including development of standard protocols for reporting angler compliance from extensive field checks that already are being made by WDFW enforcement agents. In addition, increased effort will be placed on performing emphasis patrols in closed waters when wild steelhead are concentrated and vulnerable during priority pre-spawning, spawning, smolt outmigration, and over-summering periods. The highest priorities for focused enforcement effort targeting closed waters and angler compliance exist for the most vulnerable stocks. These include: adult summer steelhead in the Wind, Washougal, EF Lewis, and Kalama rivers, angler compliance with wild steelhead release and trout fishing regulations on the remaining rivers, and patrols aimed at poaching in closed waters when pre-spawning and spawning steelhead are vulnerable.
Timeline: 1998/99
Funding: State
Contacts: Guy Norman/Bryan Cowan/Dennis Nicks (360)696-6211

Phase 2. If additional funding is available, additional staff will be assigned to bolster habitat, fishery monitoring, and enforcement efforts.
Timeline: 1998 and beyond
Funding: Unknown (likely state)
Contacts: Wolf Dammers/Bryan Cowan/Dennis Nicks (360) 696-6211

DFW IIIB9. Increase use of volunteers for reporting of wild steelhead poaching.

Background. Existing fishery regulations were adopted to protect wild steelhead. The illegal harvest of wild steelhead adults and juveniles is a potentially high source of steelhead mortality. Illegal harvest takes place may be done willing by those retaining wild fish or unwillingly by those who are unaware laws requiring the release of wild steelhead. A strong public awareness along with a effective reporting mechanism can be successful in deterring poachers.

Phase 1. WDFW will expand efforts to utilize volunteers to help implement strategies and actions in the LCSCI. Volunteer training will include information about the relationship of wild salmonids to ecosystem functions. Opportunities to apply volunteer help will be reviewed, including mechanisms to obtain reliable and timely information about wild steelhead fishing violations.
Timeline: 1998/99
Funding: State, local
Contact: Lee Van Tussenbrook (360)696-6211; Mike Judge (360) 902-2407

DFW IIIB10. Increase education and outreach to inform anglers, the public, and other stakeholders about the importance of wild steelhead.

Background. Improving the status of wild steelhead will require that citizens have a basic understanding of the importance of wild fish, and the actions that put wild populations at risk. The extent to which wild steelhead can be restored is dependent on effective partnerships with other agencies, governments, landowners, businesses and private citizens (see Chapter 9 - Outreach and Public Education).

Phase 1. WDFW will continue to engage the public and stakeholders using various media in a variety of public forums regarding the status and needs of wild steelhead in the LCSCI area. High profile outreach will continue to be associated with implementation of the Wild Salmonid Policy. Actions will be linked to those outlined by the LCSCI Outreach and Education Steering Committee (Chapter 9). Conservation-oriented information will be provided, including pamphlets, fact sheets, news releases, posters, and video programs. State agency regional staffs have established and will be increasingly involved in many public outreach programs that will stress the importance of wild salmonids and their habitats in the LCSCI area including: (1) public presentations at various club, association, civic, and other public meetings; (2) outreach through schools via a statewide salmon-oriented curriculum aimed at grade schools; (3) volunteer projects including monitoring efforts such as snorkel surveys, smolt and adult trapping, habitat inventory, creel surveys, and nutrient enhancement; and (4) random outreach through staff contacts with the public in the field. WDFW has established a volunteer coordinator position for the Washington Coast and Lower Columbia River areas to assist with local public outreach activities. Activities by local governments, the private sector, and other citizen groups, will also be important to effective outreach.
Timeline: 1998/99

Funding: State
Contact: Lee Van Tussenbrook (360)696-6211

Phase 2. WDFW will identify gaps and needs regarding public outreach and information regarding wild steelhead and their habitat in the LCSCI area. A strategic plan for wild salmonid outreach and education will be developed in coordination with the LCSCI outreach and education Steering Committee (Chapter 9). Additional funding will be sought to designate a full time public affairs and education coordinator position to support the LCSCI and related conservation initiatives that will be developed for other species. The implementation of many activities to protect and improve conditions for steelhead stocks is expected to be greatly influenced by watershed forums; thus, WDFW will seek to secure funding so that the best available scientific information can be made available in support of local watershed groups and planning processes.
Timeline: 1999 and beyond
Contact: Lee Van Tussenbrook (360)696-6211

DFW IIIB11. Develop hatchery operations plans for each hatchery program consistent with the WSP. These plans will include clear goals and objectives, specific operational components, risk management and monitoring and evaluation measures. Performance will be audited on a systematic basis.

This measure is the same as DFW IA3 and DFW IVA4.

Monitoring:

In general, monitoring parameters for Objective A will be similar to those described under Factor for Decline I.

Various approaches will be needed to monitor measures associated with Objective B. Examples include: hatchery operations plans and reports (Future Brood Document and production reports summarizing hatchery fish marked); harvest management plans and reports (annual harvest, regulation, and escapement management/survey processes); and enforcement reports.

Relationships to SSOP:

Most LCSCI conservation measures for this factor are similar to those in the SSOP.

Coordination needs (ongoing and new) include:
- Annual harvest/regulation processes
- Evaluation of hook and release mortality
- Enforcement
- Outreach and education

ECOLOGICAL/ECOSYSTEM INTERACTIONS

Factor for Decline:

IV. Ecological Interactions Influenced By Human Activities

Aquatic communities in which wild steelhead exist are shaped by complex biological interactions within and between species. Human activities can affect these ecological interactions to the detriment of wild steelhead populations.

Biological Objective:

A. Minimize the adverse effects of competition and predation on wild steelhead.

Conservation Measures:

DFW IVA1. Assess risks to wild steelhead imposed by ecological interactions with hatchery fish.

Background. Various salmonid species are artificially propagated and released into anadromous waters in the LCSCI area. Resident salmonids are not stocked into anadromous waters. Salmon and steelhead are released from lower Columbia River hatcheries and can pose undesired competitive and predatory risks to wild steelhead, especially when the hatchery fish are larger than their wild counterparts. Methods to assess ecological risks associated with hatchery fish are available (e.g., Pearsons and Hopley 1998).

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. All hatchery programs will follow specific ecological risk assessments and management plans to avoid adverse impacts to wild populations.

Phase 1. Priorities for risk assessments pertaining to wild steelhead include: (1) hatchery steelhead, and (2) hatchery coho. Consistent with the prioritization framework in Chapter 12, WDFW will review and prioritize wild steelhead stocks and perform initial risk assessments. A summary report will be prepared by the end of 1998. The summary report will also identify risks to other species of concern (e.g., chum, chinook, cuthroat) due to conservation strategies for steelhead.
Timeline: 1998/99
Funding: State, federal
Contacts: Dan Rawding (360)696-6211; Howard Fuss (360) 902-2664; Todd Pearsons (509) 925-4467

Phase 2. WDFW will seek funding to complete ecological risk assessments for all stocks within two years. (i.e., by 2000). WDFW will perform ecological risk assessments for wild steelhead stocks in the LCSCI area to identify and prioritize key interactions issues, associated wild stocks, and hatchery programs. A progress report will be prepared at the end of 1998, and a summary report including recommendations, will be prepared at the end of the two year period. Additional or expanded risk assessments will be performed as needed based on initial findings.
Timeline: 1999 and beyond
Funding: Unknown
Contact: Dan Rawding (360) 696-6211; Howard Fuss (360) 902-2661

DFW IVA2. Minimize competitive and predation impacts on wild steelhead due to trout, steelhead, and salmon hatchery programs.

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. All hatchery programs will follow specific ecological risk assessments and management plans to avoid adverse impacts to wild populations.

Background. One of the primary ecological risks to wild steelhead from hatchery programs arises when hatchery steelhead fail to exit from release areas after release and instead remain and compete with pre-existing wild steelhead for food and space. These problems can be of greater concern when hatchery steelhead are larger than their wild counterparts. Available research has shown that such hatchery steelhead residuals are typically socially dominant over wild steelhead. Most hatchery steelhead promptly emigrate downstream to the ocean after release. Hatchery juveniles that do not outmigrate promptly as intended and instead take up residence in freshwater for some period of time are termed "residuals".

Phase 1. With only one exception, resident trout are not released into anadromous waters in the LCSCI area. Releases of hatchery trout generally go into lakes or other standing water bodies. Associated with measure DFW IVA1 and DFW IVA4, WDFW will review hatchery programs for all species released into waters having wild steelhead and will identify and prioritize wild steelhead stocks, streams, and/or areas or sites where interspecific ecological interactions risks from hatchery releases are highest. As a result of this process, an initial effort will be made to develop and implement risk management plans and responses. This process will include consideration of the extent to which predator swamping with hatchery fish may benefit wild stocks.
Timeline: 1999
Funding: State, federal
Contacts: Howard Fuss (360) 902-2661, Dan Rawding (360)696-6211

Phase 2. WDFW will continue work on tasks associated with high priority risk management planning or implementation activities not covered under Phase 1.
Timeline: 1999 and beyond
Funding: Unknown
Contact: Dan Rawding (360) 696-6211 and Howard Fuss (360) 902-2661

DFW IVA3. Eliminate releases of juvenile hatchery steelhead likely to residualize.

Background. One of the primary ecological risks to wild steelhead from hatchery programs arises when hatchery steelhead fail to exit from release areas after release and instead remain and compete with pre-existing wild steelhead for food and space. These problems can be of greater concern when hatchery steelhead are larger than their wild counterparts. Available research has shown that such hatchery steelhead residuals are typically socially dominant over wild steelhead. Most hatchery steelhead promptly emigrate downstream to the ocean after release. Hatchery juveniles that do not outmigrate promptly as intended and instead take up residence in freshwater for some period of time are termed "residuals".

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. All hatchery programs will follow specific ecological risk assessments and management plans to avoid adverse impacts to wild populations.

Phase 1. WDFW will develop hatchery operations and monitoring protocols to ensure that hatchery steelhead likely to residualize will not be released where they may compete with wild steelhead. In the short term, this may involve establishing size thresholds whereby fish of a smaller than desired size would not be released. Other measures of smolt readiness may also be utilized. Hatchery steelhead juveniles not released as intended may be distributed to closed systems for recreational use. Key uncertainties associated with smoltification and residualism will be reviewed and prioritized for evaluation. WDFW will track numbers of hatchery steelhead released and not released to assess effectiveness, costs, and other program variables.
Timeline: 1998/99
Funding: State, federal, private
Contacts: Howard Fuss (360) 902-2664, Dan Rawding (360) 696-6211

Phase 2. WDFW will seek funding to accommodate priority needs identified in Phase 1. Priorities may include needed features such as: modification of hatchery facilities or programs to improve means of effective and efficient sorting and handling of smolts and non-smolts and evaluation of methodologies to better predict which hatchery pre-smolts become residuals.

Timeline: 1999 and beyond
Funding: Unknown
Contacts: Dan Rawding (360) 696-6211, Howard Fuss (360) 902-2661

DFW IVA4. Develop hatchery operations plans for each hatchery program consistent with the WSP. These plans will include clear goals and objectives, specific operational components, risk management and monitoring and evaluation measures. Performance will be audited on a systematic basis.

This measure is the same as DFW IA3, and DFW IIIB11.

Biological Objective:

B. Manage non-indigenous fish to avoid significant negative impact to wild steelhead due to interspecific interactions.

Conservation Measures:

DFW IVB1. Inventory the distribution and population abundance of non-indigenous fishes in waters with current or future potential populations of wild steelhead.

Background. Many non-salmonid non-indigenous fish species exist in the LCSCI area and other parts of the Columbia River Basin (e.g., bass, walleye). Little is known about the extent to which these species adversely influence wild steelhead populations. However, available information suggests these fishes pose ecological risks (e.g., predation or competition) to wild steelhead where they co-occur with wild steelhead.

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. Control the numbers, varieties, habitat changes, and distribution of non-indigenous species or stocks that allow them to compete with, prey on, or parasitize salmonids and other indigenous species. Introductions of fish populations will be managed to avoid significant adverse impacts on wild populations.

Phase 1. WDFW will attempt to coordinate with ODFW and other appropriate entities to identify available information on the distribution and abundance of non-indigenous fish species in the LCSCI area. An inventory and monitoring design will be developed for funding under Phase 2.
Timeline: 1998/99
Funding: State, federal
Contacts: Dan Rawding/John Weinheimer (360) 696-6211, Bill Zook (360) 902-2821

Phase 2. If sufficient funding is available, WDFW will implement the field inventory plan developed in Phase 1. In addition, WDFW (again possibly in coordination with ODFW) will identify critical uncertainties for detailed evaluations of key inventory issues.
Timeline: 1999 and beyond
Funding: Unknown
Contact: John Weinheimer (360) 696-6211, Bill Zook (360) 902-2821

DFW IVB2. Identify risks to wild steelhead due to interactions with non-indigenous fishes (e.g., via ecological risk assessments).

Background. Many non-salmonid non-indigenous fish species exist in the LCSCI area and other parts of the Columbia River Basin (e.g., bass, walleye). Little is known about the extent to which these species adversely influence wild steelhead populations. However, available information suggests these fishes pose ecological risks (e.g., predation or competition) to wild steelhead where they co-occur with wild steelhead.

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. Control the numbers, varieties, habitat changes, and distribution of non-indigenous species or stocks that allow them to compete with, prey on, or parasitize salmonids and other indigenous species. Introductions of fish populations will be managed to avoid significant adverse impacts on wild populations.

Phase 1. WDFW will perform initial assessments of risks to wild steelhead stocks in the LCSCI due to non-indigenous fishes, based on available information. Order of stock priority will follow the framework in Chapter 12.
Timeline: 1999.
Funding: State
Contacts: John Weinheimer (360) 696-6211, Bill Zook (360) 902-2821

Phase 2. Funding will be sought to plan and implement evaluations of critical species interactions risks to improve understanding of risks and the extent of actual impacts to recovery of priority stocks.
Timeline: 1999 and beyond
Funding: Unknown
Contacts: John Weinheimer (360) 696-6211, Bill Zook (360) 902-2821

DFW IVB3. Based on risk assessments, manage non-indigenous fish culture and fisheries to avoid significant adverse consequences of interactions with wild steelhead.

Background. Many non-salmonid non-indigenous fish species exist in the LCSCI area and other parts of the Columbia River Basin (e.g., bass, walleye). Little is known about the extent to which these species adversely influence wild steelhead populations. However, available information suggests these fishes pose ecological risks (e.g., predation or competition) to wild steelhead where they co-occur with wild steelhead.

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. Control the numbers, varieties, habitat changes, and distribution of non-indigenous species or stocks that allow them to compete with, prey on, or parasitize salmonids and other indigenous species. Introductions of fish populations will be managed to avoid significant adverse impacts on wild populations.

Phase 1. WDFW will actively promote and participate in a scientific workshop on non-indigenous species issues. The workshop would review pertinent information on the abundance and distribution of non-indigenous fishes, including their interactions with indigenous anadromous salmonids, and potential actions to reduce adverse interactions.
Timeline: 1999
Funding: State
Contacts: Bill Zook (360) 902-2821, John Weinheimer (360) 696-6211

Phase 2. Where risk assessments indicate high likelihood of adverse impacts to wild steelhead stocks due to interactions with non-indigenous species, WDFW will scrutinize potential remedial actions for priority implementation. Implementation of some actions may not require additional funding; however, needed actions may require intensive efforts, thus additional funding will likely be required.
Timeline: 1999 and beyond
Funding: Unknown
Contacts: John Weinheimer (360) 696-6211, Bill Zook (360) 902-2821

Monitoring:
Assess and develop ecological interactions goals and standards:
- Identify interspecific competition/predation parameters (e.g., size at release (by species), spatial and temporal overlap, residualism)

Develop/document ecological risk assessments, applications, and evaluations (as needed)

Hatchery operations plans and production reports.

Monitor competition/predation parameters (hatchery release reports):
- Assess/develop time-size relationship for juvenile wild steelhead
- Assess occurrence of residual hatchery steelhead (in key/index areas)
- Develop non-indigenous fish species inventory

Relationships to SSOP:

Most LCSCI conservation measures for this factor are similar to those in the SSOP.

Coordination needs include:
- Support and/or collaborate with other entities pursuant to a proposed scientific workshop regarding review of relevant technical information on potential ecological interactions between non-indigenous fishes and wild anadromous salmonids.
- Potential collaboration with ODFW to inventory non-indigenous species in shared steelhead waters.

Factor for Decline:

V. <u>Predation By Native Species</u>

Certain native fish species, marine mammals, and birds are capable of preying on wild steelhead. Some species, like Northern squawfish in mainstem areas of the Columbia River, have been the subject of evaluation and control programs. In general, the abundance of marine mammals and birds appears to have increased substantially in recent years. These increases may have been at least partly due to human activities. It is unclear to what extent these predators may adversely impact the abundance of wild steelhead stocks. Where wild steelhead stocks are depressed, potential impacts of predation by piscivorous (fish-eating) native fish, birds, and marine mammals could be important risk factors that may inhibit stock rebuilding.

Biological Objective:

A. Develop strategies to assess and manage wild steelhead losses to predation by native resident fishes, marine mammals, and birds via research and control.

Conservation Measures:

DFW VA1. Assess the extent to which native resident fishes, marine mammals, and birds prey on wild steelhead.

Background. Juvenile salmonids can be preyed upon by a number of native fish, marine mammal, and bird species. However, this is not an unnatural circumstance, because all of these species have evolved together for thousands of years. Current conditions in the Columbia River ecosystem have become highly altered by human activities. Depressed wild steelhead stocks may now be especially vulnerable to the mortality caused by native

predators. This mortality may affect the likelihood that wild stock rebuilding efforts will be successful, at least for certain stocks or areas. Based on available information it is not clear to what extent controlling predator populations will effectively contribute to rebuilding of wild steelhead stocks.

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. Healthy predator populations (e.g., marine mammals, birds, fish) may be controlled as necessary when they are an important factor in not achieving spawner escapement goals. Activities must be consistent with applicable law and jurisdictions.

Phase 1. WDFW will perform an initial cursory overview of available information on predatory risks to wild steelhead stocks in the LCSCI area posed by native species (marine mammals, fish, birds). Potentially significant risks posed by locally abundant predators will be identified. The relationship between identified risks and underlying human activities contributing to these risks will also be identified (e.g., species management and habitat alteration).
Timeline: 1999
Funding: State, federal
Contacts: Dan Rawding/John Weinheimer/Fred Dobler (360) 696-6211; Steve Jeffries (360) 589-7285

Phase 2. WDFW will collaborate with other state, federal, and other entities to ascertain the extent to which native species pose predatory risks and impacts to wild steelhead in the LCSCI area. Priority research and evaluation questions will be identified. Funding opportunities will be sought to determine and evaluate the likelihood of adverse effects on wild steelhead stocks, especially where risks due to locally abundant predators are high.
Timeline: 1999 and beyond
Funding: Unknown
Contacts: Dan Rawding/Pat Miller (360) 696-6211, Steve Jeffries (360)589-7285

DFW VA2. As appropriate, based on available information, develop control programs in coordination with federal agencies.

WSP Performance Standards:
Ecological Interactions: The standard for ecological interactions is "no significant negative impact" on wild populations. Actions will be taken to minimize risk, which will be estimated for each species within individual regions. Healthy predator populations (e.g., marine mammals, birds, fish) may be controlled as necessary when they are an important factor in not achieving spawner escapement goals. Activities must be consistent with applicable law and jurisdictions.

Phase 1. Where immediate benefits are likely, WDFW will attempt to develop appropriate control plans for priority known predation problems, consistent with legal constraints and in coordination with appropriate agencies.
Timeline: 1999
Funding: State
Contacts: Dan Rawding/John Weinheimer/Fred Dobler (360) 696-6211

Phase 2. Depending on the extent to which measures DFW VA1 and DFW VA2 (Phase 1) point to the prospect of positive benefits of predator control, funding will be solicited to explore appropriate strategies likely to afford effective management of predators impacting priority wild steelhead stocks. Due to federal responsibilities for certain marine mammals and sea birds, WDFW will seek federal cooperation and funds as appropriate.
Timeline: 1999 and beyond
Funding: Unknown
Contacts: Dan Rawding/Fred Dobler (360) 696-6211

Monitoring:

Key monitoring elements include:
- Review, assess, and as appropriate, bolster monitoring efforts of target predators.
- Develop predation impact evaluation in collaboration with Oregon, federal agencies and other parties.
- Identify potential predation "hot spots" (e.g., passage facilities, ladders); implement initial legal deterrent strategies. Coordinate to identify critical human influenced habitat issues and management opportunities.
- Prepare and review internal and external annual reports of ongoing and new evaluations and control efforts.

Relationships to SSOP:

LCSCI conservation measures for this factor are similar to those in the SSOP.

Coordination needs include: participate with Oregon, federal agencies, and others to develop and implement predation investigations and management strategies.

Factor for Decline:

VI. <u>Reductions In Ecosystem Nutrients From Reduced Run Sizes</u>

Anadromous fish species are adapted to return to natal streams for spawning. After spawning, salmon die and their carcasses decompose, providing an important source of nutrients supporting aquatic and terrestrial food webs. These food webs are important to the survival and growth of juvenile salmonids and other species.

Reductions in salmon and steelhead run sizes have lead to corresponding decreases in the number of carcasses available to infuse nutrients into watersheds. Although nutrient enrichment from artificial placement of carcasses may benefit natural production of steelhead, benefits are not likely to be major without improvement in other, more fundamentally critical habitat factors. In addition, nutrient benefits will accrue to the extent that increases in abundance of other wild salmonids occurs. Successful restoration or reintroduction of co-existing species will be key components in efforts to enhance nutrient inputs.

Biological Objective:

A. Increase return of ecosystem nutrients supplied by salmonid carcasses in watersheds/areas where nutrient levels would be of greatest benefit to productivity..

Conservation Measures:

DFW VIA1. Use hatchery salmon and steelhead carcasses to increase wild steelhead production in priority watersheds/areas.

Background. The life cycle of anadromous salmonids generally ends after they spawn in gravels in their natal streams and rivers. The carcasses of spawned out adults then remain in the streams where decomposition processes disperse nutrients essential for aquatic food webs. This aspect of the anadromous salmonid life cycle is the only way that rare minerals and other nutrients are transported far into the freshwater environment from the ocean. Thus, decomposition of carcasses provides a key linkage to the aquatic ecosystem, benefiting a wide variety of aquatic (and even terrestrial) life, that in turn provides ecological support for ensuing generations of wild salmonids.

As the abundance of various wild anadromous salmonid species has declined recently, there has been an associated decline in the extent to which of nutrients were transported back into watersheds. Available information suggests artificial placement of salmon and steelhead carcasses may improve stream productivity; however, this practice is not expected to positively influence rebuilding efforts as much as measures addressing other factors for decline. Recent WDFW analyses suggest that very large numbers of carcasses would be necessary to produce significant increases in stream productivity.

WSP Performance Standards:
Ecological Interactions: Maintain wild salmonid populations at diverse, abundant levels that naturally sustain salmonid ecosystem processes and diverse indigenous species and their habitats. This will primarily be done by meeting the spawning escapement goal, but hatchery carcasses may be used for this purpose during rebuilding phases.

Phase 1. Areas will be identified where distribution of surplus hatchery salmon and/or steelhead carcasses may provide the greatest benefit to productivity of wild steelhead stocks at risk. After receiving any necessary permits, and in cooperation with willing

landowners, WDFW will organize volunteers to help place carcasses in priority locations. Carcass placements in the LCSCI area began in the winter of 1996-97 (e.g., EF Lewis, See Appendix 3).
Timeline: Task initiated/ongoing
Funding: State, local
Contact: Donna Hale (360) 696-6211

Phase 2. Carcass placement into priority stream reaches will be expanded based on an assessment of need and availability. Some of these actions will not be completely dependent on additional funding availability. Emphasis will be placed on obtaining funds for the design and implementation of an intensive effort to evaluate the extent to which carcass enhancement benefit wild steelhead and other anadromous salmonids.
Timeline:1999 and beyond
Funding: Unknown
Contacts: Donna Hale (360) 696-6211, Steve Evans (360) 902-2677

DFW VIA2. Establish nutrient enrichment goals and standards by watershed and monitor status.

Background. As the abundance of various wild anadromous salmonid species has declined recently, there has been an associated decline in the extent to which of nutrients were transported back into watersheds. Available information suggests artificial placement of salmon and steelhead carcasses may improve stream productivity.

WSP Performance Standards:
Ecological Interactions: Maintain wild salmonid populations at diverse, abundant levels that naturally sustain salmonid ecosystem processes and diverse indigenous species and their habitats. This will primarily be done by meeting the spawning escapement goal, but hatchery carcasses may be used for this purpose during rebuilding phases.

Phase 1. Develop nutrient enrichment standards and goals for individual watersheds. Draft guidelines have been developed and distribution goals were established in 1996-97 and 1997-98. Use escapement management for other anadromous species (e.g., coho, chinook, and chum) to help achieve these goals.
Timeline:1998 and beyond
Funding: State
Contact: Donna Hale/Dan Rawding (360) 696-6211, Steve Evans (360) 902-2677

Monitoring:

Track carcass availability and distribution via hatchery operations program reports.
Annual review of application of WDFW carcass nutrient assessment and distribution protocol.
Identify and summarize priority carcass distribution efforts and evaluations.

Relationships to SSOP:

LCSCI conservation measures for this factor are similar to those in the SSOP.

Coordination needs include:

- Disease monitoring protocols and practices.
- Support and/or participation in design and implementation of a comprehensive experimental design to assess the efficacy of carcass additions to watersheds.